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| 09/577,347 | 05/24/2000 | Maria Ronay | YOR9-2000-0109 | 5095 |

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| EXAMINER | |
|---|---|
| SONG, MATTHEW J | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1765 | |

DATE MAILED: 12/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. 09/577,347 | Applicant(s) RONAY, MARIA |
|---|---|---|
| | Examiner Matthew J Song | Art Unit 1765 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *24 March 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1 and 13-36* is/are pending in the application.

4a) Of the above claim(s) *1* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

## DETAILED ACTION

### *Response to Arguments*

1. In view of the Appeal Brief filed on 3/24/2003, PROSECUTION IS HEREBY REOPENED. A new grounds of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 13-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admission in view of Ronay (US 5,876,490).

Applicant's admitted prior art teaches in many microelectronics applications a $Si_3N_4$ layer is deposited under a $SiO_2$ layer to serve as a polish stop, particularly in Shallow Trench Isolation (STI) structures. Admission also teaches a layer of silicon dioxide, silicon nitride and/or silicon oxynitride insulator is located beneath a metal layers such as copper, tungsten or aluminum layer and a liner such as Ti, TiN, Ta and TaN to act as a polish stop and the liner can be removed. Admission also teaches using slurries such as silica slurry or ceria slurry (pg 2-3 of the instant specification)

Admission does not teach a slurry comprising abrasive particles and an anionic polyelectrolyte in an amount sufficient to increase the polish rate ratio of the silicon dioxide to the silicon nitride and contact with the surface of a polishing pad.

In a method of polishing, note entire reference, Ronay teaches a slurry comprises abrasive particles and a polyelectrolyte, where the polyelectrolyte is cationic when the abrasive particles are anionic and the polyelectrolyte is anionic when the abrasive particles are cationic (col 4, ln 55-65). Ronay also teaches polyacrylic acid, polymethacrylic acid, polymethylmethacrylic acid, polymaleic acid, polyvinylsulfonic acid, polyvinylamine, polyethylenimine and poly (4-vinylpryridine) (col 5, ln 25-40 and Table 1). Ronay also teaches the molecular weight of the polyelectrolyte is between about 500-10000 (col 6, ln 25-35). Ronay also teaches ceria, alumina, silica and zirconia abrasive particles at 1wt% (Example 2 and claim 14). Ronay also teaches 0.2 wt% polyacrylic acid (Example 2) and the slurry is an aqueous slurry (claim 15). Ronay also teaches planarization of aluminum, tungsten and copper (col 6, ln 50 to col 7, ln 10). Ronay also teaches a polishing pad (col 2, ln 30-40). Ronay also teaches the slurry results in reduced polishing rate at recesses while the abrasive particles maintain high polish

rates at elevations, which leads to improved planarization in shallow trench isolation applications (Abstract and col 1, ln 25-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Admission with Ronay's slurry to improve planarization, as taught by Ronay.

The combination of Admission and Ronay is silent to the amount of polyelectrolyte is sufficient to increase the polishing rate ratio of the silicon dioxide to the silicon nitride. However, the combination of Admission and Ronay teach a similar amount of abrasive particles, 1 wt%, and polyelectrolyte, 0.2 wt%, as applicant, note instant claims 24 and 26 and Example 2; therefore the amount of abrasive particles and polyelectrolyte is inherently sufficient to increase the polishing rate ratio of the silicon dioxide to the silicon nitride. Furthermore, the combination of Admission and Ronay teach the amount of polyelectrolyte and abrasive particles is selected to achieve planarization ('490 col 5, ln 14-25), which is a teaching that the amount of polyelectrolyte and abrasive particles is a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Admission and Ronay to obtain same by conducting routine experimentation of a result effective variable (MPEP 2144.05).

Referring to claims 14,22, and 28-29, the combination of Admission and Ronay teach the polyelectrolyte has a molecular weight of about 500-10000. Overlapping ranges is held to be obvious (MPEP 2144.05).

Referring to claims 17, 24, 26, 31, and 33, the combination of Admission and Ronay teach 1 wt% of abrasive particles and 0.2 wt% polyelectrolyte, this reads on applicant's abrasive particles is about 0.3-2 wt% and the amount of polyelectrolyte is about 0.05-5 wt%.

Referring to claims 25, 27, 32, and 34, the combination of Admission and Ronay teach 1 wt% of abrasive particles and 0.2 wt% polyelectrolyte, but is silent to the range of the amount of polyelectrolyte and abrasive particles. The combination of Admission and Ronay teach the amount of polyelectrolyte and abrasive particles is selected to achieve planarization ('490 col 5, ln 14-25), which is a teaching that the amount of polyelectrolyte and abrasive particles is a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Admission and Ronay to obtain same by conducting routine experimentation of a result effective variable (MPEP 2144.05).

4. Claims 13-17, 22-27, 30-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tseng (US 5,801,082) in view of Ronay (US 5,876,490).

Tseng teaches a method of making a shallow trench isolation (STI) comprising a $Si_3N_4$ layer **14** and a silicon oxide layer **22**, $SiO_2$, deposited to fill trenches **4** and is chemical/mechanically polished back to the surface of the $Si_3N_4$ layer **14**. Tseng also teaches the layer **22** is deposited to a thickness sufficient to fill the trenches and to a height tat extends above the surface of the $Si_3N_4$ layer (col 4, ln 1 to col 5, ln 25).

Tseng does not teach a slurry comprising abrasive particles and an anionic polyelectrolyte in an amount sufficient to increase the polish rate ratio of the silicon dioxide to the silicon nitride and contact with the surface of a polishing pad.

In a method of polishing, note entire reference, Ronay teaches a slurry comprises abrasive particles and a polyelectrolyte, where the polyelectrolyte is cationic when the abrasive particles are anionic and the polyelectrolyte is anionic when the abrasive particles are cationic (col 4, ln 55-65). Ronay also teaches polyacrylic acid, polymethacrylic acid, polymethylmethacrylic acid, polymaleic acid, polyvinylsulfonic acid, polyvinylamine, polyethylenimine and poly (4-vinylpryridine) (col 5, ln 25-40 and Table 1). Ronay also teaches the molecular weight of the polyelectrolyte is between about 500-10000 (col 6, ln 25-35). Ronay also teaches ceria, alumina, silica and zirconia abrasive particles at 1wt% (Example 2 and claim 14). Ronay also teaches 0.2 wt% polyacrylic acid (Example 2) and the slurry is an aqueous slurry (claim 15). Ronay also teaches a polishing pad (col 2, ln 30-40). Ronay also teaches the slurry results in reduced polishing rate at recesses while the abrasive particles maintain high polish rates at elevations, which leads to improved planarization in shallow trench isolation applications (Abstract and col 1, ln 25-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tseng with Ronay's slurry to improve planarization, as taught by Ronay.

The combination of Tseng and Ronay teach raised region of $SiO_2$ **22** and lower regions of $Si_3N_4$ **22** and the ratio of abrasive particles and polyelectrolyte is selected to result in reduced polishing rate at recesses and high polish rate at elevation, this reads on applicant increase the polishing rate ratio of the silicon dioxide to the silicon nitride. Furthermore, the combination of Admission and Ronay teach a similar amount of abrasive particles, 1 wt%, and polyelectrolyte, 0.2 wt%, as applicant, note instant claims 24 and 26 and Example 2; therefore the amount of

abrasive particles and polyelectrolyte is inherently sufficient to increase the polishing rate ratio of the silicon dioxide to the silicon nitride

The combination of Tseng and Ronay teach the polyelectrolyte has a molecular weight of about 500-10000. Overlapping ranges is held to be obvious (MPEP 2144.05).

The combination of Tseng and Ronay teach 1 wt% of abrasive particles and 0.2 wt% polyelectrolyte, but is silent to the range of the amount of polyelectrolyte and abrasive particles. The combination of Tseng and Ronay teach the amount of polyelectrolyte and abrasive particles is selected to achieve planarization ('490 col 5, ln 14-25), which is a teaching that the amount of polyelectrolyte and abrasive particles is a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tseng and Ronay to obtain same by conducting routine experimentation of a result effective variable (MPEP 2144.05).

5. Claims 18-21 and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Booth (US 5,814,236) in view of Ronay (US 5,876,490).

Booth teaches a silicon dioxide layer **28**, this reads on applicant's member, and aluminum plugs **36**, this reads on applicant's metal surface, are subjected to a chemical mechanical planarization technique with a slurry and polishing pad, where the aluminum plugs are elevated above the surface of the silicon dioxide layer (col 4, ln 5-45 and Fig 5).

Booth does not teach a slurry comprising abrasive particles and an cationic polyelectrolyte in an amount sufficient to increase the polish rate ratio of the metal to the member.

In a method of polishing, note entire reference, Ronay teaches a slurry comprises abrasive particles and a polyelectrolyte, where the polyelectrolyte is cationic when the abrasive particles are anionic and the polyelectrolyte is anionic when the abrasive particles are cationic (col 4, ln 55-65). Ronay also teaches polyacrylic acid, polymethacrylic acid, polymethylmethacrylic acid, polymaleic acid, polyvinylsulfonic acid, polyvinylamine, polyethylenimine and poly (4-vinylpryridine) (col 5, ln 25-40 and Table 1). Ronay also teaches the molecular weight of the polyelectrolyte is between about 500-10000 (col 6, ln 25-35). Ronay also teaches ceria, alumina, silica and zirconia abrasive particles at 1wt% (Example 2 and claim 14). Ronay also teaches 0.2 wt% polyacrylic acid (Example 2) and the slurry is an aqueous slurry (claim 15). Ronay also teaches planarization of aluminum, tungsten and copper (col 6, ln 50 to col 7, ln 10). Ronay also teaches a polishing pad (col 2, ln 30-40). Ronay also teaches the slurry results in reduced polishing rate at recesses while the abrasive particles maintain high polish rates at elevations, which leads to improved planarization in shallow trench isolation applications (Abstract and col 1, ln 25-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Booth with Ronay's slurry to improve planarization, as taught by Ronay.

The combination of Booth and Ronay teach raised region of aluminum **36** and lower regions of Silicon dioxide **28** and the ratio of abrasive particles and polyelectrolyte is selected to result in reduced polishing rate at recesses and high polish rate at elevation, this reads on applicant increase the polishing rate ratio of the metal to the member. Furthermore, the combination of Booth and Ronay teach a similar amount of abrasive particles, 1 wt%, and polyelectrolyte, 0.2 wt%, as applicant, note instant claims 24 and 26 and Example 2; therefore

the amount of abrasive particles and polyelectrolyte is inherently sufficient to increase the polishing rate ratio of the silicon dioxide to the silicon nitride

The combination of Booth and Ronay teach the polyelectrolyte has a molecular weight of about 500-10000. Overlapping ranges is held to be obvious (MPEP 2144.05).

The combination of Booth and Ronay teach 1 wt% of abrasive particles and 0.2 wt% polyelectrolyte, but is silent to the range of the amount of polyelectrolyte and abrasive particles. The combination of Booth and Ronay teach the amount of polyelectrolyte and abrasive particles is selected to achieve planarization ('490 col 5, ln 14-25), which is a teaching that the amount of polyelectrolyte and abrasive particles is a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Booth and Ronay to obtain same by conducting routine experimentation of a result effective variable (MPEP 2144.05).

***Conclusion***

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ronay (EP 0846740) is equivalent to Ronay (US 5,876,490) and is published in 1998.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS

SUPERVISOR
NADINE G. NORTON
PRIMARY EXAMINER